#6
8/3/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	ALVIN L. NEELEY ET AL.	)	
		)	Attorneys' Ref.: P112554
Serial No.:	09/440,149	)	
		)	Examiner: Underwood, D.
Filing Date:	11/15/99	)	
		)	Group: 3652
Title:	MANHOLE COVER LIFTING APPARATUS AND METHOD	)	

DECLARATION OF ED MECUM

I, ED MECUM, having a home address of 9020 22nd Avenue SW, Seattle, Washington, 98106, state and aver the following:

1. I began working at Seattle City Light in 1972, and my first job was as a helper on a line crew. This work involved the installation and maintenance of overhead electrical power lines. In 1981 my assignment at Seattle City Light was changed to be a helper on a network crew (which are also called a distribution system underground network crew). This involved the installation and maintaining of the underground high voltage distribution system. In about 1989, I was made a crew chief (foreman) at Seattle City Light of a network crew, but doing work that was quite similar to my assignment in 1981 as a helper.

2. In Seattle City Light there are commonly three men on such a crew. In a normal day's work, the three people in the crew would ride in a van to one or more job sites where there is a vault, with most of these being an underground vault with a vault cover or lid. Our van would be a little bit smaller than a UPS truck and would be loaded so that the total load with various equipment, such as splicing equipment, ladders, safety equipment, etc., generally takes up most all of the room in the truck. At the job site the helper would normally set up the metal barriers and fences around the manhole cover (vault lid). The manhole cover would be removed from its position covering the vault

opening, and then one or more of the workmen would go downwardly through the vault into the vault area to perform the work.

3. Quite often, the manhole covers are located on a roadway (generally Paved roadway) and a typical manhole cover could be about 42" in diameter and weigh 400 pounds or possibly somewhat less for a smaller vault lid. One typical way of lifting a manhole cover from its closing position is to connect a city hook to the sides of the manhole cover. This city hook has an end hooking member and a rod or bar about ¾" in diameter and about 2 ½ feet long. At the top of the bar there is a cross handle (so that the bar and the handle has an overall T-shape). One man would be on one side of the manhole cover and one on the other, and both would lift on the T-bar to lift the cover out of the vault opening. The two men raise the manhole cover about two inches above the surrounding street surface and then move the manhole cover sideways to let it rest on the surface.

4. In some instances, the manhole cover is "stuck" in the opening. This could happen, for example, when the street has been paved or re-paved and the paving material has worked in around the edges of the manhole cover. When this happens, it is common for the worker to use a sledgehammer and beat on the manhole cover until it is loose. Then the same lifting operation is employed.

5. This general system of lifting the manhole covers has been used by Seattle City Light ever since I began working there, and to the best of my knowledge this is generally the same system that is used throughout the industry. I was asked by Mr. Hughes, the patent attorney whom I understand is handling the above-noted patent application, as to how long these vaults with the vault lids for electrical power distribution systems have been in existence and how long it has been used. Again, to the best of my knowledge, these have been in existence when underground electrical distribution networks have been used, and these have been in existence for about the last 90 years.

6. I've also been asked by Mr. Hughes what other systems have been tried or used. Other methods have been tried, such as attaching a fulcrum or other member to a lid to the manhole cover and providing some sort of handle for lifting it. However, to the best of my knowledge, a manual operation where the worker lifts the manhole cover above the hole by pulling upwardly on a handle or other device remains the commonly used method of removing manhole covers. With a 400-pound lid, the two workmen would each be exerting an upward pull of about 200 pounds (somewhat more if the lid is stuck in some manner).

7. I have also been asked by Mr. Hughes whether I am familiar with a vault lid cover which is the subject matter of a U.S. patent application which I understand has been filed by Mr. Neeley and Mr. Davis. I have examined a drawing entitled Fig. 1 showing a vault lid cover with a lifting tool positioned over the vault lid cover. More specifically, the tool is made up of a beam which has one end support indicated at 28 about which the beam pivots. At the opposite end of the beam there is a pair of wheels 40 by which the beam can be rotated about the pivot location at 28. There is also a screw actuated lifting member which has a handle 66 and a connecting end at 62 to connect to the lid. I am fully familiar with this tool, and I have seen it in operation, and have used it many times.

8. More specifically, Mr. Hughes has asked me to comment on a memorandum dated August 30, 1994 which I had sent to Steve Davis. A copy of that letter is attached to this Declaration. As you can see form the contents of that letter, the tool that is shown in the attached Fig. 1 was used in Seattle at the location of Third and University on the 29th of August 1994. We used the tool on three different types of covers. As can be seen from the comments in my letter, this tool removed one cover that was wedged into the roadway so tightly that it would have bent the truck when the usual method of truck power and a lanyard and hook would be used. Care must be taken with this method as the lanyard or hook can fail under load.

9. I have also been asked by Mr. Hughes to comment on the statement which I had made that mounting this tool in a handy location would encourage its constant use and

make it more user friendly as the crew becomes accustomed to it. To explain this further, if there are inconveniences or time delays in trying to get a piece of equipment set up, or if it is awkward to handle, the person on the crew is likely not going to take the trouble to use it but simply go back to the tried and true way of using the hook, even though it does put strain on the person's back. Also, the equipment has to be easily accessible. This is why I suggested in my letter that the main part of the tool could be mounted to the front exterior of the truck and the miscellaneous pieces be placed in a small box attached to the inside of the rear door. This tool can be set up very quickly, and it is very simple to use. Further, there is the convenience that after the tool is used to move the vault lid off to the side, then the replacement becomes very easy since its just the reverse operation of moving the tool about a pivot point back over the vault lid opening.

10. Mr. Hughes has also asked me to comment in my statement that this could drastically reduce the risk of back injuries. While I can't give hard statistics on this, on the basis of my experience in my jobs for Seattle City Light, at least half of people on the crew (probably a lot more) have some sort of back problems. The lifting and removal of vault lids is one of the jobs that probably places as much strain on the person's back as any other job that we do. Quite often a person on the crew (particularly a younger person) will take the lifting of the vault cover as a physical challenge and do the lifting in the usual way. However, after a person has sustained a back injury, if he can be provided with a tool that would reduce the odds of re-injuring the back, this tool would be a real help.

11. Mr. Hughes has also asked me to comment on the need for a tool such as this and whether it would be what he calls "obvious". My answer to that is that I've been doing this kind of work since 1972, and over the years I've fully realized that the lifting of vault lids is a common cause of back injury. Nothing has come along which seems to provide an answer that is practical, meaning it is one that would be sufficiently user friendly to be acceptable in the day to day work routine. This tool seems to answer the problem with what appears to me to be a practical solution.

12. I, Ed Mecum, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

EXECUTED this 15 **day of** May, **2000.**

Ed Mecum

ED MECUM

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	ALVIN L. NEELEY ET AL.	)	
		)	Attorneys' Ref.: P112554
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		)	Group: 3652
Title:	MANHOLE COVER LIFTING APPARATUS AND METHOD	)	

DECLARATION OF STEVEN M. DAVIS

I, STEVEN M. DAVIS, having a home address of 125 So. 309th St. Federal Way, WA 98023, state and aver the following:

1. I am the Steven M. Davis who is one of the co-inventors of the above noted patent application.

2. I received my Bachelor of Science Degree from Seattle Pacific University in 1989, majoring in Exercise Physiology and Biomechanics (Exercise Science). After graduation, I worked a short time in the field of physical therapy and was an orthopedic medical assistant at Providence Downtown Medical Center in Seattle, Washington. I then attended Auburn University, obtaining my Masters Degree in 1992 in Exercise Physiology including Biomechanics, with an emphasis in Industrial Engineering and Ergonomics. Since that time, I have worked as an Ergonomist occupational safety and health consultant, and for the past five years one of my major clients has been Seattle City Light, which employs a number of utility work crews who commonly remove and replace manhole covers on a day to day basis.

3. In performing my consulting services for Seattle City Light, I soon became aware of the problem of back and other musculoskeletal injuries which resulted from employees of various utility companies removing and replacing vault lids (commonly

called "manhole covers"). The manual removal of vault lids is either a one or two person operation depending on the weight of the vault lid and/or its impacted condition on the roadway. One common way of removing a vault lid is by using a T-shaped bar with a hook which is placed in a designated hole drilled in the surface of the vault lid, and the lid is removed by the person lifting up and backwards until the front edge has been dislodged from the frame. Then the vault lid is pulled from the vault access and dragged on the roadway approximately three to six feet until safely cleared of the vault access. When the underground vault work is completed, the vault lid is dragged from its resting position and securely placed back in the vault access opening. Not only is this a time consuming operation but the physical task involved often results in back and other musculoskeletal injuries to the work crews. Mr. Alvin Neeley, my co-inventor and I undertook the design and construction of a vault lid removal apparatus which is the subject matter of our above noted application.

4. Prior to 1994, Mr. Neeley and I conceived the idea of a design for a vault lid lifting apparatus, such as described in the above noted application, and began developing a prototype. By January 11, 1994, a fully functional prototype had been constructed and tested, and this was fully documented in a five page document which is attached to this declaration, signed and dated January 11, 1994. Pages 1 and 2 of this document are typed pages, and on the second page, this was signed and dated on January 11, 1998 by Mr. Alvin Neeley and myself, and was also signed by three witnesses, namely Mr. Alvin Neeley Jr., Gerald Munro, and Johnny P. Neeley, Jr. On page 3 there are shown three photographs displaying the apparatus, as described and claimed in the present invention in its operating position lifting a vault cover, and this page is properly witnessed as of January 11, 1994. On page 4, there is shown a test set up measuring the lifting force of the vault, and this is also properly witnessed. On page 5, there are three more photographs showing the apparatus components, and this also is properly witnessed.

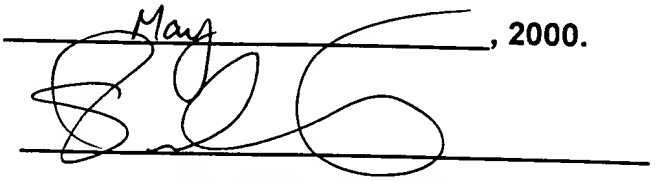
5. Subsequent to January of 1994 and continuing through that year and up until the

filing date of, June 12, 1995 of the parent application of the present application, continuing testing and development work was undertaken. As evidence of this, there is enclosed a copy of a letter from Mr. Ed Mekum, Network Crew Chief of Seattle City Light, commenting on the testing which took place on August 29, 1994. The tool was used in the actual working environment and was used to lift vault lids at streets in Seattle.

6. Between January 1994 and June 1995 we continued to field test the tool at Seattle City Light involving various field crews. We continued to modify the tool and changed the design to light weight aluminum for ease of use. We also developed information for our Patent application and sought out a suitable patent attorney for this project.

7. I, Steven M. Davis, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

EXECUTED this 15 **day of** May **, 2000.**



STEVEN M. DAVIS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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I, STEVEN M. DAVIS, having a home address of 125 So. 309th St. Federal Way, WA 98023, state and aver the following:

1. I am the Steven M. Davis who is one of the co-inventors of the above noted patent application.

2. I received my Bachelor of Science Degree from Seattle Pacific University in 1989, majoring in Exercise Physiology and Biomechanics (Exercise Science). After graduation, I worked a short time in the field of physical therapy and was an orthopedic medical assistant at Providence Downtown Medical Center in Seattle, Washington. I then attended Auburn University, obtaining my Masters Degree in 1992 in Exercise Physiology including Biomechanics, with an emphasis in Industrial Engineering and Ergonomics. Since that time, I have worked as an Ergonomist and occupational safety and health consultant, and for the past five years one of my major clients has been Seattle City Light, which employs a number of utility work crews who commonly remove and replace manhole covers (vault lid covers) on a day to day basis.

3. I have been asked by Mr. Robert B. Hughes, the patent attorney who had

prepared and is prosecuting the above application, to provide certain information concerning the prior art methods of removing and replacing vault covers (often called "manhole covers"), and the effect of this is placing stress on the back of the workman involved in employing such processes. Mr. Hughes has further asked me to perform a similar analysis of the operation of the apparatus as described and claimed in the present invention, and how this relates to the physical stress that might be placed on
the workman and how this relates to back injuries.

4. On the basis of (a) my formal education (particularly my graduate studies in industrial engineering, physiology and ergonomics), and also on the basis of (b) my experience as a consultant in these areas, and (c) the studies and further research I have done in these areas, I believe I can make the following statements with reasonable assurance that these are correct and accurate.

5. My analysis of the various prior art practices of manually removing vault lids clearly indicates that this exposes the workman to substantial risk of back injuries. Further, the statistical analysis which I have done in this area clearly confirms this. The awkward lifting positions required, when manually lifting vault covers, coupled with the high lifting forces required clearly exceeds the maximal permissible limit (MPL) for safe lifting associated with excessive compressive forces on the L5SI disc in the Lumbar Spine.

   Additionally, the forces placed on other joints in the body such as the knees and shoulders often exceed the MPL or Recommended Load Lifted for safe lifting.

   These excessive joint and spine forces significantly increase the risk for musculoskeletal injuries when vault covers are manually lifted. Risks are also significantly increased depending on environmental and road conditions as well as the impacted condition of an already heavy vault cover ranging in weight from 150-

600 pounds. Lifting forces can exceed 1,000 pounds when lifted from the center of mass of the lid.

6. The manual removal of vault lids is either a one or two person operation, depending on the size of the vault lid and/or its impacted or condition on the roadway.
   i. Vault lids typically weigh 150-600 pounds each and range from 24 inches to 44 inches in diameter. The force required to remove a vault lid is significantly increased when it is impacted by traffic and the accumulation of foreign debris such as asphalt, dirt, etc. The average lifting force required for the majority of severely impacted 44 inch vault lids has been determined to be in excess of 1000 pounds and can be as high as 2000-3000 pounds when lifted from the center of mass, depending such factors of frequency of removal, maintenance of the roadway, volume of traffic, etc.
   ii. To remove a vault lid, one common method is to use a C-shaped hook welded to a T-bar lifting device that is placed in a designated hole drilled in the surface of the vault lid. The operator's feet are positioned properly for stability. The lid is removed by lifting up and backwards until the front edge has been dislodged from the frame. Then the vault lid is pulled from the vault access and dragged approximately three feet to six feet until safely clear of the vault access. When all underground vault work has been completed, the vault lid is dragged from its resting position and securely placed onto the vault access. Depending on the weight/size of the lid, dragging the lid on the roadway often takes 60-100 pounds of forceful pulling while stepping backwards.
   iii. The total time required for set up and manual removal and repositioning of the vault lid is approximately three to five minutes unless a vault lid is severely impacted into the roadway as described above. Generally, if impacted, a sledgehammer is used to pound the outside edge of the vault lid and break the securance seal or a truck with a bomb hoist must be called to mechanically remove the impacted vault lid. Whether the vault

lid is actually lifted and removed or attempted to be manually removed and found to be stuck, the risk of injury is significant each time.

iv. Due to the substantial physical challenges of manually lifting and handling vault lids using those methods, various automated or semi-automated mechanical lifting devices devised, such as truck lift using the power of the truck and a Lanyard, a Quinn Roller Block which is a leverage device, or any other leverage bar device having been designed and integrated in utility work. However, these have not been widely accepted due to awkwardness and/or inability to be consistently used in all situations, and vault lid removal is still predominantly manually performed.

7. In general, on a statistical basis, a large percentage of occupational injuries resulting from physically demanding work are strain/sprain type back injuries. These commonly occur when a person is performing a lifting motion, and particularly when the lifting movement involves not just a straightforward lifting motion with a relatively safe load, but where the lifting motion is accompanied by the person being in an unbalanced position, and/or conducting the lifting motion where there are lateral or twisting forces coupled with high lifting and pulling forces. I have analyzed the biomechanics of lifting when workmen manually remove and replace vault covers, and I find the following:

   i. the lifting of vault lids can require an awkward unbalanced stance;

   ii. excessive forward bending (awkward lifting postures) coupled with extreme lifting requirements increases spinal disc pressures particularly at L4-L5. These lifting demands require high force output from the back musculature including the erector spinae muscles, which are more endurance muscles than power muscles. These demands often far exceed maximal permissible load limits and recommended load limits for the back;

   iii. frequent unstable footing when lifting, pulling and dragging vault lids.

Continually performing this type of physically demanding work significantly

increases the likelihood of a serious cumulative work related musculoskeletal disorder (WMSD) affecting the back and/or other musculoskeletal joints including the knees, shoulders, etc. In general, even if the best and safest lifting postures and techniques are assumed when lifting vault lids, the physical requirements and absolute demands significantly increases the risk for severe injuries.

8. I have performed a similar analysis relating to the physical motion of the workmen in utilizing the present application. When using the vault lid lifting tool, which is shown and claimed in the present invention, the risk for cumulative types of musculoskeletal injuries is virtually eliminated. There is no awkward lifting, dragging the vault lid or excessive force requirements. The tool is easily and efficiently operated so that when the person is exerting any force, he is standing in a fully upright position. The lid is easily lifted using a hand crank or screw gun coupled with a lifting jack affixed to a horizontal frame over the lid. The lid is lifted quickly using 4-11 pounds of hand arm force for up to a 900 pound lift. A ratchet device can be used along with the tool if lifting force exceeds 900 pounds. Because the person can operate the tool in an upright position and hand/arm force requirements are minimal, footing is always stable.

   Once the lid is lifted using this tool, the lid is rolled out of the way (one hundred and eighty degrees) to access the underground vault. This can also be accomplished with the person being in an upright position. When done, the tool is rolled one hundred eighty degrees back to its original spot and the lid is replaced directly into the vault access hole. No lifting or dragging is required in either case.

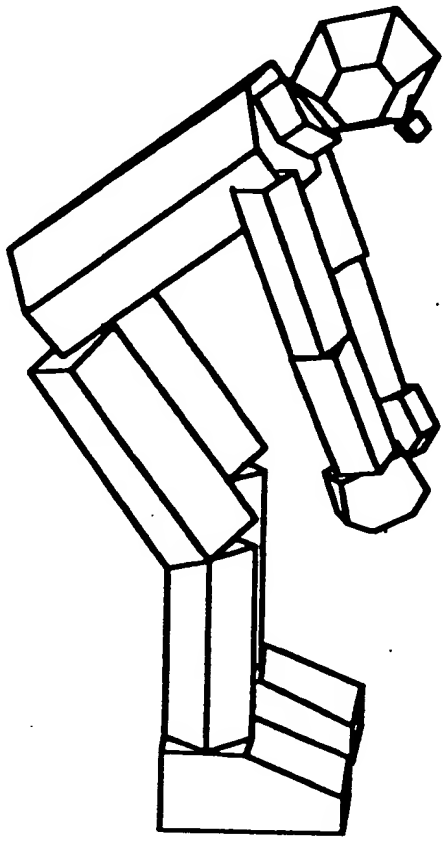
9. I, Steven M. Davis, hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code,

and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

EXECUTED this 15 **day of** May **, 2000.**

STEVEN M. DAVIS

Analyst: IOE Task: New Task



Anthropometry

Gender:
- (•) Male
- ( ) Female

Height & Weight:
- ( ) 5th %ile
- ( ) 50th %ile
- (•) 95th %ile
- ( ) Specific

Height (Inches)	74
Weight (pounds)	217

Hand Location

Hand Location (Inches):

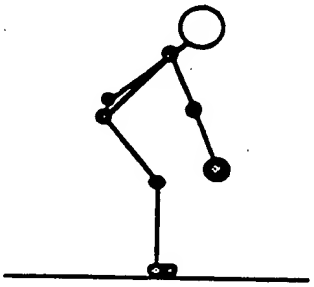
	Left	Right
Horizontal	12	12
Lateral	-6	6
Vertical	24	24

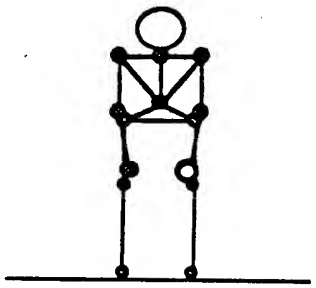
- ( ) Supine (Palms Up)
- ( ) Semi-Prone
- (•) Prone (Palms Down)

Forces At Hands

Action:
- ( ) Lift Up
- ( ) Press Down
- ( ) Pull In
- ( ) Push Away
- (•) Specific

	Direction (Deg.): Horiz.	Vert.	Magnitude (Pounds):
Right:	90	-60	120
Left:	90	-60	120

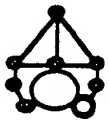




3DSSPP™

Analyst: IOE
Task Name: New Task
Action: Specific

Gender: Male
Height: 74 inches
Weight: 217 pounds

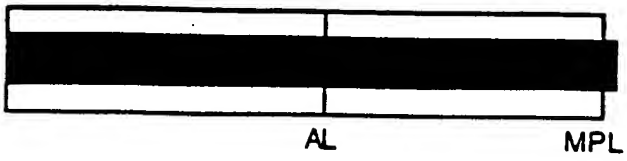


Analysis Summary

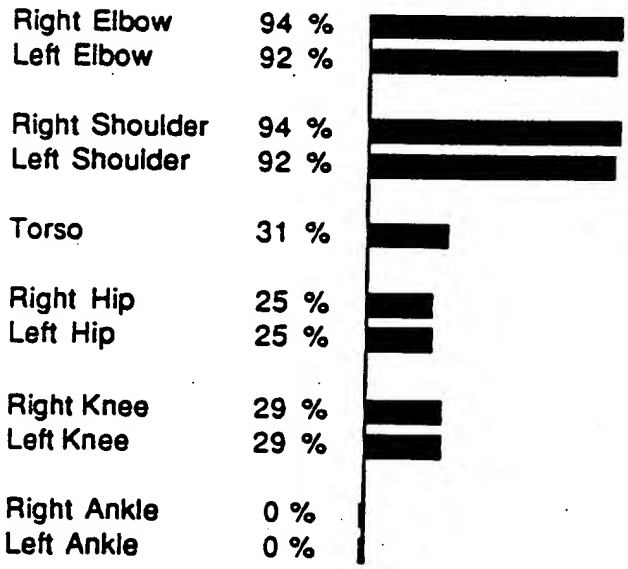
Analyst: IOE Task: New Task

Predicted Compression Force at L5/S1:

1480 ± 118 Pounds



Predicted Percent Capable:



Seattle City Light

Memorandum

AUG 31 1994

DATE: August 30, 1994

TO: Steve Davis

FROM: Ed Mecum, Network Crew Chief

SUBJECT: Manhole/Cover Removal Tool

Thank you for bringing out your new tool to Third and University on the 29th of August for testing and evaluation. I feel that this new light weight tool will be an efficient and economical tool for removing manhole covers. Monday's test put the tool to use on three different type of covers. Your removal tool easily lifted a cover that is normally wedged into the roadway so tightly, it bends the hook when removed by our usual method of truck power and a lanyard and hook.

I believe the use of this tool could drastically reduce the chance of back injuries in the Network. To accomplish this, I recommend the following:

> That the main part of the tool be mounted on the rear exterior of the truck. That the miscellaneous pieces be placed in a small box attached to the inside of the rear door. This arrangement places the tool in an easily available location and would encourage the crew to use it, as most splicing work is done off the back of the truck. Mounting this tool in a handy location would encourage its constant use and make it more user friendly as the crew becomes accustomed to it. I feel one of the distinct advantages of the tool is that the lid once removed is in the grip of the fixture and is easily rolled back in place, often times underground crews believe a heavy lid will return to place easily when dragged back by hooks. This leaves personnel vulnerable to back injuries. I would be interested in having one of the tools mounted on truck 4287 for further testing and evaluation.

Ed Mecum Jr

EM:jp
345\MANHOLE.REM